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CLINICAL-ANAMNESTIC AND ECHOCARDIOGRAPHIC MARKERS OF NEONATAL SEPSIS AT DIFFERENT GESTATION AGE OF NEWBORN

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Abstract: *neonatal sepsis remains one of the leading causes of morbidity and mortality in the neonatal age. The involvement of the myocardium in sepsis remains insufficiently studied, in particular in neonatology, where issues of myocardial dysfunction in neonatal generalized infection seem even more controversial, especially in neonatal sepsis at different gestational terms. Objective. To study specific clinical and anamnestic and echocardiographic parameters in infants depending on gestational age for optimization of the prognosis in neonatal sepsis. Material and research methods. To achieve this goal, we observed 57 newborns with a verified diagnosis of "Neonatal sepsis". Group I (23 patients – 40.3%) included newborns with a gestational age of 37-42 weeks, Group II – 34 premature infants (59.7%) with a gestation of up to 36 weeks. The latter group, depending on the gestational age, was divided into IIA subgroup, which was formed by 21 prematurely born patients with NS with a gestational age of 32-36 weeks, and the IIB subgroup – 13 newborns born before 32 weeks of gestation. Research results. The analysis showed that the severity of the impairment in the general condition of the examined newborns general condition was assessed as severe in 47.8% of newborns of group I, in 88.2% of cases in group II (PI: II <0.05), in 85.7% of representatives of subgroup IIA (PI: IIA <0.05) and in 92.3% of children of subgroup IIB (PI: IIB <0.001). It is shown that every third child (30.4%) of group I, 67.6% of newborns of group II (PI: II <0.05), half (52.4%) of the representatives of subgroup IIA (PII: IIA <0.01) and all seriously ill patients (92.3%) of subgroup IIB (PI: IIB, IIA: IIB <0.05) required cardiopulmonary resuscitation in the delivery room. Thus, in relation to full-term patients, the risk of this significant postnatal factor of emergency is likely to increase: for group II: OR - 4.77 (95% CI 2.63-8.68), RR - 2.17 (95% CI 1.57-3.0), AR = 0.37; and for premature babies with a gestational age of less than 32 weeks (IIB subgroup), respectively: OR – 27.44 (95% CI 11.73-64.19), RR – 7.55 (95% CI 5.58-10.21), AR – 0.65. The correlation analysis showed that in premature infants suffering from NS, the increase in the functional capacity of the left ventricular myocardium was associated with the female sex (for EF r = 0.94, P = 0.0001, for FS - r = 0, 94, P = 0.0001) and the number of days of inotropic support (for EF r = 0.68, P = 0.043, for FS - r = 0.71, P = 0.03). Conclusions. The analysis of echocardiographic parameters in the group of premature infants revealed a direct correlation between the ejection fraction and cardiovascular resuscitation immediately after birth (r = 0.64) and the duration of inotropic drugs (r = 0.68).*

Key words: newborn; neonatal sepsis; cardiovascular system.

Introduction. Sepsis of newborns remains one of the main causes of morbidity and mortality in the neonatal age, in particular, sepsis remains the leading cause of the loss of seriously ill patients in pediatric intensive care units.

Epidemiological studies of the incidence and mortality of patients with neonatal sepsis (NS) in the world fluctuate significantly (Jawad I., et al., 2012) and differ in different countries with different income levels, but researchers remain united on the worst prognosis of this life-threatening pathology in cohorts of premature infants, which are characterized by physiological and, in particular, immunological immaturity, require a long stay in hospital and invasive procedures for care and treatment (Shane AL., et al., 2017).

Currently, sepsis is understood as a systemic inflammatory reaction syndrome (SIRS) induced by infection, with multiple organ dysfunction or tissue hypoperfusion being decisive for so-called severe sepsis (Goldstein B., et al., 2005). Clinical manifestations of multiple organ mismatch in newborns receiving treatment for NS are usually quite nonspecific symptoms or focal signs of infection, including: temperature instability, hypotension, hypoperfusion of tissues with pale or gray tinge, spotty skin rash, tachycardia or bradycardia, apnea, respiratory distress, grants, cyanosis, irritability, lethargy, cramps, bloating, impaired food tolerance, jaundice, petechiae or purpura on the skin, bleeding. The onset of NS can be manifested by rather meager signs, namely apnea or tachypnea with retraction, or tachycardia, and later in

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patients with NS, respiratory failure, heart failure, pulmonary hypertension, shock, renal failure, impaired liver function, cerebral edema or thrombosis, hemorrhages in adrenal glands or their insufficiency, hematopoietic dysfunction (neutropenia, thrombocytopenia, anemia) and disseminated intravascular coagulation (DIC syndrome) are noted.

Sepsis-mediated myocardial dysfunction, described as early as 1984 by Parker et al., is one of the most common components of multiple organ mismatch in severe sepsis and septic shock (Li J., et al., 2019). Previous studies have shown that the incidence of left ventricular systolic dysfunction (LVSD) in severe pediatric sepsis ranged from 20% to 60% (Williams FZ., et al., 2019). In this case, the left ventricular ejection fraction (LVEF) is the diagnostic echocardiographic criterion of LVSD, which, at values <50%, may be associated with adverse consequences of severe sepsis (Sevilla Berrios RA., et al, 2014). The frequency of myocardial dysfunction in septic shock in pediatrics ranges from 50 to 80% (Jain A., et al., 2018) with maximum manifestations on days 1-3 of the disease with normalization starting from 7-10 days of the disease.

At the same time, in both the adult and pediatric populations of patients with sepsis, evidence has been obtained that a decrease in LVEF below 50% does not correlate with the prognosis of severe sepsis or septic cheek (Sevilla Berrios RA., et al., 2014; Raj S., et al., 2014). The explanation for this may be the greater sensitivity of the myocardial receptors in children before drug exposure, the expressive ability to recover, the absence of comorbidity, and the like.

The involvement of the myocardium in sepsis, the so-called "septic cardiomyopathy" (Hawiger J., 2018), is well documented, but insufficiently studied, primarily in pediatric practice and, in particular, in neonatology, where the issue of myocardial dysfunction in neonatal generalized infection looks even more controversial, especially in emergency situations for different gestational periods of patients.

Objective. To study specific clinical and anamnestic and echocardiographic parameters in infants depending on gestational term in order to optimize the prognosis of possible development of the neonatal sepsis.

Material and research methods. To achieve this goal under our supervision on the basis of the Department of Neonatal Intensive Care, the Department of Neonatal Pathology and the Department of Nursing Premature Babies of «Chernivtsi Regional Children's Clinical Hospital» in Chernivtsi there were 57 newborns with a verified diagnosis of «Neonatal sepsis» according to current guidelines and protocols (NICE, 2016; NICE, 2021) The diagnosis of NS was established by a commission on the basis of a comprehensive clinical and paraclinical examination, in particular, early sepsis affected 26.1% of newborns in group I and 29.4% of children in group II, which accounted for 28.6% of cases in IIA subgroup and 30.8% of observations in subgroup IIB, respectively, in the remaining patients there was late neonatal sepsis.

Depending on the term gestations children were assigned to clinical comparison groups. Thus, group I (23 patients – 40.3%) included newborns with a gestation period of 37-42 weeks, group II – 34 premature patients (59.7%) with a gestational period of up to 36 weeks inclusive. The last group, depending on the gestational age, was divided into IIA subgroup, which was formed by 21 prematurely born NS patients with a gestational age of 32-36 weeks, and in the IIB subgroup – 13 newborns born before 32 weeks of gestation.

The criteria for entering the study were the age of 0-28 days of extrauterine life, the presence of the child manifestations of infectious-inflammatory process and subsequently verified the diagnosis of «neonatal sepsis». Criteria for non-admission were: other pathological conditions of the neonatal period, which are accompanied by multiple organ dysfunction, as well as congenital heart defects and myocardiopathy of other (non-infectious) origin.

The average age of full-term newborns at the time of transfer from obstetric institutions to the regional clinical hospital was 5.61 ± 1.26 days, and 5.39 ± 0.51 days - in premature infants (in particular, the average age of newborns with a gestational age of 32 36 weeks – 4.11 ± 0.52 days and 7.46 ± 0.74 days in patients with IIB subgroup ($P_{II:IIB,IIA:IIB}$<0,05). The revealed differences reflected the need for a longer stabilization period for further transfer and transportation to the regional children's hospital of infants with a gestational age of less than 32 weeks. It should be noted that when transferred to the department of the regional children's clinical hospital, all newborns were hemodynamically compensated.

General characteristics of the groups are presented in table 1.

As shown in the table, the average age of the mothers of patients in the comparison groups and subgroups did not have significant differences (in all cases P> 0.05), and we also did not establish statistically significant differences in the average age of the fathers of patients with NS of the clinical groups and subgroups of comparison. Compared to girls, full-term boys suffered from NS significantly more often, and such discrepancies were not found among premature babies. It was interesting to find that the latter more often than representatives of the clinical group, were born by caesarean section, which coincides with the general trends and indicates a more frequent indications for cesarean section in mothers whose children were born at 32-36 weeks with predisposing factors to intrauterine infection.

The Intergroup differences in gestational age and indicators of physical development of newborns were

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Table 1. General characteristics of groups and subgroups of comparison (M ± SD, 95% CI)

Indicator	Group I (n=23)	Group II (n=34)	Subgroup II A (n=21)	Subgroup II B (n=13)
Gestation period, week	38,6±1,34	32,3±2,49	34,1±0,97	29,6±1,56
Sex: male female	 16 (69,5%) 7 (30,5)*	 18 (52,9%) 16 (47,1%)	 11 (52,4%) 10 (47,6%)	 7 (53,8%) 6 (46,2%)
Birth weight, g	3279,3±524,37 (95% CI: 3052,59-3506,1)	1809,5±499,51 (95% CI: 1635,27-1983,85)	2103,3±375,38 (95% CI: 1932,46-2274,21)	1335,1±237,28 (95% CI: 1191,62-1478,39)
Body length at birth, cm	52,5±3,66 (95% CI: 50,98-54,15)	42,1±4,36 (95% CI: 40,59-43,64)	44,3±2,98 (95% CI: 42,97-45,69)	38,5±3,86 (95% CI: 36,21-40,87)
Cesarean section	6 (26,1%)	19 (55,9%)#	11 (52,4%)#	8 (61,5%)#
Mother's age, years	30,1±7,76	29,5±6,53	30,1±6,53	28,7±6,71

*Note: * p<0,01 boys to girls; # p<0,05 - relative to group I.*

considered natural, reflecting the correctness of the formation of comparison groups and subgroups.

The examination and treatment of patients with NS was carried out in accordance with modern international guidelines and recommendations (Singer M., et al., 2016; Kissoon N., et al., 2017; Improving the prevention ..., 2017) with the informed consent of the child's parents.

Echocardiographic examination of newborns was carried out on a PHILIPS HD11 XE ultrasound machine with an ultrasound transducer frequency of 2.5-5 MHz, according to the standard technique and comparing the obtained results with age normative data (Prahov A.V., 2017) in one and two-dimensional modes with an assessment of the following morphometric parameters: end diastolic volume (EDV), left atrial diameter in diastole (LADd), the thickness of the posterior wall of the left ventricle in diastole (LVPWd). Left ventricular systolic function was assessed based on the value of the ejection fraction (EF) and fractional shortening (FS) (according to the Teicholz method).

The study was conducted by the method of "experiment - control" in parallel groups using a simple random sample with the informed consent of the parents of patients. Statistical processing of the study results was performed using the methods of variation statistics with the calculation of the arithmetic mean (M) and standard deviation (SD). To assess the correlation relationships, the Spearman nonparametric correlation method was used with the calculation of the strength of the relationship bond strength (r) and its probability (P). The indicators of clinical and epidemiological risk were estimated by calculations of the ratio of the odds of an event (OR) and the relative risk (RR) taking into account their 95% confidence intervals (95% CI), as well as the indicator of attributive risk (AR). The statistical processing of the actual data was carried out using the StatSoft Statistica v 6.0 program with a known number of observations (n). The critical level of significance "P" when testing statistical hypotheses in this study was considered $p < 0.05$.

The study was approved by the Commission on Biomedical Ethics of Bukovynian State Medical University.

Results and discussion. The study showed that among full-term newborns, boys suffered from sepsis significantly more often that indicated a higher risk of developing sepsis for men with OR – 5.19 (95% CI: 2.84-9.48), RR – 2.28 (95% CI: 1.64-3.15), AR – 0.39), and for premature babies such a pattern has not been established.

The obstetric anamnesis data allowed us to conclude that birth by caesarean section more often took place in the group of patients with NS of premature infants: OR – 2.7 (95% CI: 1.48-5.0), RR – 1.54 (95% CI: 1.07-2.22), AR – 0.24, which coincides with the trends in the general population of newborns (Shunko, Ye., et al., 2017) and, apparently, testified to the presence of indications for caesarean section due to certain factors. Based on this, the analysis of obstetric history and maternal health that showed the presence of obstetric and somatic pathology, which is presented in table 2.

We have not found statistically significant differences in the frequency of pathological conditions and complications of pregnancy shown in Table 2 in mothers of children of clinical comparison groups although the most common factors for the possible development of sepsis, perhaps, can be considered in these groups premature rupture of membranes and infections of the genitourinary system. The results obtained generally coincide with the general patterns of the neonatal cohort (Sirenko O., et al., 2017), but allow us to establish

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Table 2. Data on obstetric history and maternal health status

Indicator	Group I, % (n=23)	Group II, % (n=34)	Subgroup II A, % (n=21)	Subgroup II B, % (n=13)
Risk of miscarriage	13,04	11,76	14,28	7,69
History of miscarriage	8,69	14,71	9,52	23,08
Placental dysfunction	4,35	2,94	4,76	-
Polyhydramnios	17,39	8,82	14,28	-
Chorioamnionitis	-	5,88	-	15,38
Premature rupture of membranes	-	26,47	19,05	38,46
Presence of meconium water	13,04	14,71	9,52	23,08
Infections of the genitourinary system	30,43	14,71	19,05	7,69

Note: in all cases p>0.05

the role of individual factors for patients with neonatal NS, depending on the gestational age. Thus, in mothers who gave birth to children less than 32 weeks period, in comparison with mothers of patients from subgroup IIA, premature rupture of membranes was twice as often, 2.4 times more often – amniotic fluid contamination with meconium, but 2.5 times less often – indications of infectious diseases of the genitourinary system of a pregnant woman. At the same time, compared with group II, mothers of premature babies with a gestational age of less than 32 weeks had a higher risk of chorioamnionitis (OR – 2.9 (95% CI: 1.08-7.86). Compared to subgroup IIA, the risk of meconium contamination of amniotic fluid is higher (OR – 2.85 (95% CI: 1.26-6.43) and premature rupture of the membranes (OR – 2.66 (95% CI: 1.40-5.04).

According to the medical documentation of obstetric institutions, the general condition impairment of the examined newborns was assessed as severe in 47.8% of newborns of group I, in 88.2% of cases in group II ($P_{I:II}$<0.05), in 85.7 % of representatives of subgroup IIA ($P_{I:IIA}$<0.05) and 92.3% of children of subgroup IIB ($P_{I:IIB}$<0.001). The severity of the condition was due to the presence of manifestations of respiratory failure II-III degrees and instability of hemodynamics (tendency to bradycardia and hypotension). Based on the received data, the most pronounced severity of the general condition at birth was inherent in newborns with the shortest gestational age. Thus, in relation to children of group I, premature birth increased the chances of a severe general condition of patients with NS: OR – 8.16 (95% CI: 3.96-16.82), RR – 3.52 (95% CI: 2.83-4,37), AP = 0.46. These indicators of the clinical and epidemiological risk of a severe degree of impairment of the general condition at birth for patients with a gestational age of 32-36 weeks reached: OR – 6.54 (95% CI: 3.30-12.97), RR – 2.88 (95% CI: 2.39-3.72), AR – 0.43, and for patients of subgroup IIB relative to group I were, respectively: OR – 13.09 (95% CI: 5.69-30.12), RR – 5.12 (95% CI: 4.14-6.34), AR – 0.53. Such risks are primarily due to the inherent features of adaptation of premature babies (Pokhylko V., et al., 2016), and are exacerbated by the existing infectious and inflammatory process, which was a certain consequence of resuscitation, partly aggressive intensive therapy and dynamic observation, was manifested by the frequency of late NS in 70.6% of premature infants.

Thus, it is shown that in the delivery room every third child (30.4%) of group I, 67.6% of newborns of group II ($P_{I:II}$<0.05), half (52.4%)) representatives of subgroup IIA ($P_{II:IIA}$<0.01) and all critically ill patients (92.3%) of subgroup IIB ($P_{I:IIB,\ IIA:IIB}$<0.05) required cardiopulmonary resuscitation. Thus, in relation to full-term patients, the risk of this significant postnatal factor of NS is likely to increase: for group II: OR – 4.77 (95% CI: 2.63-8.68), RR – 2.17 (95% CI: 1.57- 3.0), AP = 0.37; and for premature babies with gestational age less than 32 weeks (IIB subgroup), respectively: OR – 27.44 (95% CI: 11.73-64.19), RR – 7.55 (95% CI: 5.58-10.21), AR – 0.65. It should be noted that within the group of premature infants with NS, the risk of the need for resuscitation in the delivery room increased with decreasing gestational age of newborns and was for representatives of subgroup IIB: relative to group II: OR – 5.75 (95% CI: 2.46-13.39), RR – 3.0 (95% CI: 2.60-3.48), AR = 0.39; and relative to IIA subgroup: OR – 10.89 (95% CI: 4.73-25.06), RR – 4.58 (95% CI: 3.77-5.57), AR = 0.50. It should be noted that 26.1% of newborns in group I and 41.2% of group II (respectively 23.8% of IIA subgroup and 69.2% of infants of subgroup IIB) were born in a state of asphyxia of varying severity ($P_{I:IIB,\ IIA:IIB}$<0.05). However, given the presence of clinical and paraclinical signs of infectious-inflammatory process in stabilized newborns, the genesis of myocardial dysfunction in the conditions of the departments of the regional children's clinical hospital was considered as sepsis-dependent.

According to the data of transferable epicrisis, to stabilize the general condition, part of the representatives of the comparison groups and subgroups needed volume load immediately after birth, which happened in 26.1% of cases in group I, in 61.7% of cases in group

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Table 3. The results of the assessment on the Apgar scale (in points) of the state of patients in the clinical comparison groups (M ± SD, 95% CI)

Clinical groups and subgroups	Quantity of children	Average score on the 1st minute	Average score on the 5th minute
Group I	23	6,47±1,31 (95% CI: 5,84-7,11)	7,26±2,05 (95% CI: 6,28-8,25)
Group II	34	5,94±1,23 (95% CI: 5,51-6,37)	6,17±2,16 (95% CI: 5,42-6,93)
Subgroup II A	21	6,14±1,28 (95% CI: 5,56-6,72)	6,85±0,91 (95% CI: 6,44-7,27)
Subgroup II B	13	5,61±1,12 (95% CI: 4,94-6,29)	5,07±3,07 (95% CI: 3,22-6,93)
Pt		I:IIB, IIA:IIB <0,05	I:II, I:IIB <0,05

Note: Pt is the Student's criterion

II ($P_{I:II}$<0, 05), in 57.1% of children of IIA subgroup (PI: IIA <0.05) and 69.2% of newborns of IIB subgroup ($P_{I:IIB}$<0.05). Thus, as gestational age decreases, the need for volume loading at birth increases. So, with respect to full-term patients, the risk of this event increased for children of group II: OR – 4.56 (95% CI: 2.50-8.32), RR – 2.06 (95% CI: 1.43-2.96), AR = 0.36; for patients of subgroup IIA: OR – 3.77 (95% CI: 2.08-6.84), RR – 1.87 (95% CI: 1.29-2.71), AR = 0.32; and for newborns of subgroup IIB: OR – 6.36 (95% CI: 3.44-11.78), RR – 2.47 (95% CI: 1.73-3.52), AR - 0.43.

One of the important prognostic criteria is the condition of the child immediately after birth, expressed by the Apgar score. Table 3 shows the comparative rates of adaptation of newborns according to the Apgar score, respectively, at the 1st and 5th minutes of life.

Thus, full-term infants adapted better to the conditions of extrauterine life, in premature infants these processes were worse, and the gestational age of less than 32 weeks was associated with their negative trend. Accordingly, these patients required longer inotropic cardiac support in a maternity ward. Thus, in the intensive care unit of the maternity hospital 21.7% of group I received the average daily dose of dobutamine at a rate of (6.25±2.5) μg/kg/minute during (1.8±1.1) days of treatment , in 26.5% of children of group II these indicators were (4.67±2.2) μg/kg/minute for (4.44±1.7) days ($P_{I:II}$<0.05). Depending on the gestational age, the given indicators of inotropic support were: in 23.8% of newborns of the IIA subgroup – (5.2±2.9) μg/kg/minute for (3.6±1.9) days ($P_{I:IIA}$=0,05), and in 30.8% of patients of the IIB subgroup – (4.0±1.1) μg/kg/minute for (5.5±0.6) days ($P_{I,II,IIA:IIB}$<0,05).

The results of the analysis of the hemogram of peripheral blood of newborns with NS, reflected the course of the disease and differed slightly in clinical comparison groups. However, the absolute content of platelets suggested that in premature infants the course of sepsis is associated with a decrease in the circulating pool of these blood cells. Thus, in the first clinical group of patients the content of platelets in the peripheral blood was (283.95±104.2) G/l, and in the second subgroup – only (197.63±112.8) G/l (P=0.05). The average content of platelets in the peripheral blood of group II reached (209.1±118.6) G/l and did not differ significantly from premature infants with gestational age of more than 32 weeks (IIA subgroup) – (215.74±124.4) G/l (p>0.05), as well as less than 32 weeks (p>0.05), however, was significantly lower relative to full-term infants (p<0.05).

It is shown that in relation to the clinical group of full-term infants, NS in premature infants is accompanied by an increased risk of thrombocytopenia (<150 G/l): for children of group II, the odds ratio (OR) of this event is 5.02 (95% CI: 2.23-11.31), attributive risk (AR) – 0.36; for representatives of IIA subgroup: OR – 5.24 (95% CI: 2.33-11.79), AR – 0.37; for patients of IIB subgroup – OR – 4.67 (95% CI: 2.06-10.55), AR – 0.35.

All patients with NS underwent echocardiographic examination during transfer to the neonatal intensive care unit after stabilization of their condition in the maternity hospital. Based on this, the results of this study could be interpreted as a response of the myocardium to treatment.

Table 4 shows the comparative results of the main indicators of echocardiography in children of clinical comparison groups.

According to current research results, in patients with refractory septic shock, cardiac output (as determined by echocardiography) can be low, normal, or high, since the hemodynamic parameters of cardiac output and systemic vascular resistance are heterogeneous and develop over time in response to inotropic and vasopressor support. (Raj S., et al., 2014; Ceneviva G., et al., 1998). Wide variations in the frequency of myocardial dysfunction may be due to the difference in the selection of the patient, the history of successful resuscitation measures, the time interval between the onset of the disease and the study, the use of other echocardiographic parame-

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Table 4. Comparative average results of echocardiographic examination of children of clinical comparison groups (M ± SD)

Echo-CG indicators	Groups and subgroups of patients				Pt
	I (n=23)	II (n=34)	IIA (n=21)	IIB (n=13)	
EF (%)	74,22±6,85	77,90±5,27*	77,19±5,72	79,4±4,03*	*<0,05 to I group
FS (%)	38,68±5,27	39,58±3,38	39,05±3,12	40,70±3,8	>0,05 in all cases
EDV (mm)	17,2±1,82	15,12±1,87*	15,66±1,65*	14,16±1,89*,**	*<0,05 to I group **<0,05 to IIA group
LADd (mm)	9,0±0,97	8,17±0,53*	8,23±0,54*	8,07±0,52*	*<0,05 to I group
Thickness of LVPW (mm)	3,1±0,31	2,85±0,34*	2,89±0,3*	2,77±0,41*	*<0,05 to I group

Note: EF - ejection fraction; FS - fractional shortening; EDV - end diastolic volume; LADd - diameter of the left atrium in diastole; thickness of LVPW - the thickness of the posterior wall of the left ventricle; Pt is the Student's criterion.

ters with different limit values, the peculiarities of inotropes and myocardial sensitivity to them, ventilation of the lungs (cardiopulmonary interaction), etc. (Baranwal AK., et al., 2020).

The observed increase in morphometric characteristics of the heart with increasing gestational age of patients was consistent with current literature, and higher values of EF in premature infants relative to children of group I were evaluated as a sign of activation of adaptive mechanisms (Yarukova EV., et al., 2016). The correlation analysis showed that in premature infants suffering from NS, the increase in the functional capacity of the left ventricular myocardium was associated with the female sex (for EF r=0.94, P=0.0001, for FS - r=0, 94, P=0.0001) and the number of days of inotropic support (for EF r=0.68, P=0.043, for FS - r=0.71, P=0.03).

At the same time, the thickness of the posterior wall of the left ventricle correlated with body length (r=0.72, P=0.03), and the results of FS in patients of subgroup IIA were associated with head circumference (r=-0.88, P=0.05) that is, the more premature the baby and the smaller the circumference of the head, the higher the FS. Interestingly, the correlations with the female sex EF and FS were preserved only in the IIA subgroup (for EF r=0.96, P=0.01, for FS - r=0.91, P=0.03), but at gestational age patients less than 32 weeks were absent. For these premature infants, inverse correlations of FS indicators with body weight (r=-0.99, P=0.005) and heart rate (r=-0.99, P=0.004), as well as direct correlations of thickness of LVPW with body weight at birth (r=0.99, P=0.005) and heart rate (r=0.99, P=0.004).

Based on this, poorer adaptation at birth, the need for cardiopulmonary support, longer duration of administration of drugs of positive inotropic action in the first days of life of premature infants could affect the results of their echocardiographic examination. Thus, inotropic support in a maternity hospital lasting 3 days or more was received by a third (30.8%) of patients with a gestational age of less than 32 weeks, one in five premature babies (20.6%) and only 8.7% of newborns. clinical group. However, in relation to full-term infants of group I the chances of long-term (≥ 3 days) inotropic support increased slightly in patients of subgroup IIB: OR – 4.67 (95% CI 2.07-10.55), RR – 1.81 (95% CI: 1.0-3.64), AP = 0.35; and representatives of group II: OR – 2.72 (95% CI: 1.17-6.36), RR – 1.51 (95% CI: 0.71-3.18), AR = 0.24.

Although the correlation analysis showed that in the group of premature infants the results of PV were inversely related to the score on the Apgar scale at 1 minute of life (r=-0.43, P=0.016) and at 5 minutes r=-0.43, P=0.017). Instead, the direct correlation of EF was determined with measures of cardiopulmonary resuscitation in the delivery room (r=0.64, P=0.0001), the duration of administration of inotropic drugs (r=0.68, P=0.04), and for FS – with the severity of the general condition at birth (r=0.36, P=0.05) and artificial respiration (r=0.39, P=0.03).

Conclusions. Analysis of obstetric history of mothers of newborns with neonatal sepsis showed that the development of neonatal sepsis in full-term infants is more often associated with the male sex and infectious diseases of the genitourinary system during pregnancy, and for premature infants - more frequent premature rupture of membranes and contamination of amniotic fluid with meconium.

The analysis of clinical and anamnestic parameters in neonates with neonatal sepsis showed that with decreasing gestational age increases the risk of severity of impairment of the general condition, the need for cardiopulmonary resuscitation, volume loading, and longer inotropic support of cardiac activity.

It was found that in premature infants the course of neonatal sepsis is associated with caesarean section, lower score on the Apgar scale, the need for cardiopulmonary resuscitation and artificial respiration in the delivery room, longer inotropic support in the future, higher chances of thrombocytopenia that should be con-

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sidered at the management of children with the presence of risk factors for intrauterine infection.

Prospects for further research. To study and search for new and informative diagnostic markers of cardiovascular lesion in newborns with sepsis as one of the prerequisites for rational therapy aimed at eliminating these disorders and preventing further complications.

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КЛІНІКО-АНАМНЕСТИЧНІ ТА ЕХОКАРДІОГРАФІЧНІ МАРКЕРИ НЕОНАТАЛЬНОГО СЕПСИСУ ЗА РІЗНОГО ГЕСТАЦІЙНОГО ВІКУ НОВОНАРОДЖЕНИХ

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Анотація: сепсис новонароджених залишається однією з основних причин захворюваності та смертності у неонатальному віці. Недостатньо вивченою залишається участь міокарду у сепсисі, зокрема, в неонатології, де питання міокардіальної дисфункції при неонатальній генералізованій інфекції видаються ще більш дискусійними, особливо при неонатальному сепсисі за різного терміну гестації хворих. Мета дослідження. Для оптимізації прогнозу при неонатальному сепсисі (НС) вивчити окремі клініко-анамнестичні та ехокардіографічні показники у немовлят залежно від гестаційного віку. **Матеріал і методи дослідження.** Для реалізації поставленої мети під нашим спостереженням знаходились 57 новонароджених із верифікованим діагнозом «Неонатальний сепсис». До I групи (23 хворих - 40,3%) увійшли новонароджені з терміном гестації 37-42 тижня, до II групи – 34 передчасно народжених немовлят (59,7%) з гестацією до 36 тижнів включно. Останню групу залежно від терміну гестації розподіляли на IIA підгрупу, яку сформував 21 передчасно народжений хворий на НС із терміном гестації 32-36 тижнів, а до IIB-підгрупи - 13 новонароджених, які народились в терміні до 32 тижнів гестації. Результати досліджень. Проведений аналіз показав, що тяжкість порушення загального стану обстежених новонароджених оцінювалася як важка у 47,8% новонароджених I групи, у 88,2% випадків у II групі ($P_{I:II}$<0,05), у 85,7% представників IIA підгрупи ($P_{I:IIA}$<0,05) та у 92,3% дітей IIB підгрупи ($P_{I:IIB}$<0,001). Показано, що у пологовій залі потребували проведення заходів серцево-легеневої реанімації кожна третя дитина (30,4%) I групи, 67,6% новонароджених II групи ($P_{I:II}$<0,05), половина (52,4%) представників IIA підгрупи ($P_{II:IIA}$<0,01) та усі важкі хворі (92,3%) IIB підгрупи ($P_{I:IIB,IIA:IIB}$<0,05). Таким чином, відносно доношених хворих ризик даного вагомого постнатального чинника НС вірогідно зростав: для II групи: ВШ – 4,77 (95% ДІ: 2,63-8,68), ВР – 2,17 (95% ДІ: 1,57-3,0), АР = 0,37; а для передчасно народжених із терміном гестації менше 32 тижнів (IIB підгрупа) відповідно: ВШ – 27,44 (95% ДІ: 11,73-64,19), ВР – 7,55 (95% ДІ: 5,58-10,21), АР - 0,65. За допомогою проведеного кореляційного аналізу показано, що у передчасно народжених дітей, які страждали на НС, зростання функціональної

КЛИНИКО-АНАМНЕСТИЧЕСКИЕ И ЭХОКАРДИОГРАФИЧЕСКИЕ МАРКЕРЫ НЕОНАТАЛЬНОГО СЕПСИСА У НОВОРОЖДЕННЫХ С РАЗНЫМ ГЕСТАЦИОННЫМ ВОЗРАСТОМ

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Аннотация: сепсис новорожденных остается одной из основных причин заболеваемости и смертности в неонатальном возрасте. Недостаточно изученной остается участие миокарда в сепсисе, в частности, в неонатологии, где вопрос миокардиальной дисфункции при неонатальной генерализованной инфекции выглядят еще более дискуссионными, особенно у новорожденных с разным гестационным возрастом. Цель работы. Для оптимизации прогноза при неонатальном сепсисе (НС) изучить отдельные клинико-анамнестические и эхокардиографическом показатели у новорожденных в зависимости от гестационного возраста. Материал и методы исследования. Для реализации поставленной цели под нашим наблюдением находились 57 новорожденных с верифицированным диагнозом «Неонатальный сепсис». В I группу (23 больных - 40,3%) вошли новорожденные со сроком гестации 37-42 недели, в II группу - 34 недоношенных новорожденных (59,7%) с гестационным возрастом до 36 недель включительно. Последнюю группу в зависимости от срока гестации распределили на IIA подгруппу, которую сформировал 21 преждевременно рожденный больной НС со сроком гестации 32-36 недель, а IIB-подгруппу - 13 новорожденных, родившихся в сроке до 32 недель гестации. Результаты исследования. Проведенный анализ показал, что тяжесть нарушения общего состояния обследованных новорожденных оценивалась как тяжелая в 47,8% новорожденных I группы, в 88,2% случаев во II группе ($P_{I:II}$<0,05), у 85,7% представителей IIA подгруппы ($P_{I:IIA}$<0,05) и в 92,3% детей IIB подгруппы ($P_{I:IIB}$<0,001). Показано, что в родильном зале требовали проведения мероприятий сердечно-легочной реанимации каждый третий ребенок (30,4%) I группы, 67,6% новорожденных II группы ($P_{I:II}$<0,05), половина (52,4%) представителей IIA подгруппы ($P_{II:IIA}$<0,01) и все тяжелые больные (92,3%) IIB подгруппы ($P_{I:IIB,IIA:IIB}$<0,05). Таким образом, относительно доношенных больных риск данного весомого постнатального фактора НС достоверно возрастал: для II группы: ВШ - 4,77 (95% ДИ: 2,63-8,68), ВР - 2,17 (95% ДИ: 1,57- 3,0), АР = 0,37; а для недоношенных со сроком гестации

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спроможності міокарду лівого шлуночка асоціювало із жіночою статтю (для ФВ r=0,94, P=0,0001, для ФУ – r=0,94, P=0,0001) та кількістю діб проведеної інотропної підтримки (для ФВ r=0,68, P=0,043, для ФУ – r=0,71, P=0,03). Висновки. Проведений аналіз ехокардіографічних показників виявив у групі передчасно народжених дітей прямий кореляційний зв›язок фракції викиду з проведенням серцево-судинної реанімації одразу після народження (r=0,64) та тривалістю введення інотропних препаратів (r=0,68).

Ключові слова: новонароджений; неонатальний сепсис; серцево-судинна система.

менее 32 недель (IIB подгруппа) соответственно: ВШ - 27,44 (95% ДИ: 11,73-64,19), ВР - 7,55 (95% ДИ: 5,58-10,21), АР - 0,65. С помощью проведенного корреляционного анализа показано, что у преждевременно рожденных детей, страдающих НС, рост функциональной способности миокарда левого желудочка ассоциировало с женским полом (для ФВ r=0,94, P=0,0001, для ФУ - r=0, 94, P=0,0001) и количеством суток проведенной инотропной поддержки (для ФВ r=0,68, P=0,043, для ФУ - r=0,71, P=0,03). Выводы. Проведенный анализ эхокардиографических показателей обнаружил в группе недоношенных новорожденных прямую корреляционную связь фракции выброса с проведением сердечно-сосудистой реанимации сразу после рождения (r=0,64) и продолжительностью введения инотропных препаратов (r=0,68).

Ключевые слова: новорожденный; неонатальный сепсис; сердечно-сосудистая система.